In this research project I will estimate the relationship between environmental inequalities and income inequalities in the Limpopo River Basin in Zimbabwe. Extremely high rates of poverty are present in this region in conjunction with a high proportion of the population dependent on agriculture as a main source of livelihood provision. There is little economic literature, however, that attempts to understand how household dependencies on the environment influence income levels and income dynamics over time. Through this research project I hope to reveal more about the depth and degree to which rural households rely on the natural environment. The ultimate goal of this research project is to enable policy makers to adopt policies that better conserve the most important environmental goods.

I will use the requested funds to oversee data collection in Zimbabwe beginning in summer 2012. Additionally, I will develop an econometric model that explains the relationship between the level of environmental goods that a household has access to and the household’s income and income trajectory. Funds will be used for travel to Zimbabwe to initiate data collection and stipend during model development.
The budget form is complete including the funds sought for this project, other pending applications for this project, and the amount/source of matching or other funds.

The applicant’s faculty advisor is copied on the application email. Professional students w/o advisors check NA.

All necessary approvals are pending or received.
What Does the Environment Do For Us: Incorporating Environmental Assets into Poverty Dynamics

Martha Rogers
Consortium on Law and Values in Health, Environment and the Life Sciences
(Student Proposal)

February 13, 2012

I. Project Description

Background

Two of the biggest problems facing the 21st century are poverty and increasing rates of environmental degradation. Development economics is typically concerned with the first of these two problems – methods of promoting economic growth and household welfare – while environmental economics is concerned with the latter – evaluating market failures that cause environmental degradation. There is little economic literature to date, however, on the ways in which environmental dependencies interact with household livelihoods and welfare. For some perspective, a quick search of the economics literature using EconLit for “poverty & environment” returns 10 results compared to 15,981 results returned from a search for “poverty” alone. This research project is situated at the intersection of these two subdisciplines. I will systematically analyze poverty – both poverty measurements and poverty dynamics – to gain insight into how households in a given region rely on certain environmental goods and how limited access to these goods inhibits investments and income improvements.

Consider the case of sub-Saharan Africa – a region where almost half of the population lives in poverty and the population is also extremely dependent on the environment for their livelihoods. According to the 2005 World Development Indicators approximately 50.9 percent of the population lives on less than $1.25 a day. This level of extreme poverty is higher than anywhere else in the world (India is second with 41.6 percent). Furthermore, approximately 56 percent of the population is dependent on agriculture for their livelihoods (The World Bank, 2011).

Complicating this process, however, is the environmental crisis that sub-Saharan Africa currently faces. The World Bank estimates that soil nutrient mining affects approximately 75 percent of agricultural land in the region (The World Bank, 2008).¹

¹Soil nutrient mining refers to when land is used too intensively to allow full soil nutrient regeneration. Some of the most important nutrients found in the soil are nitrogen, phosphorus, sulfur, and boron.
(2001) estimate that the R ratio between cropping and fallow periods in 2001 was 0.6 in sub-Saharan Africa and that a ratio of 0.2 would be necessary for sustainable natural soil fertility regeneration. Additionally, researchers estimate that deforestation in Africa occurs at twice the average rate of the rest of the world (Morris et al., 2007).

This research project draws on the unique developmental and environmental challenges faced by this region; the project will be conducted in the Limpopo River Basin in southern Zimbabwe. I will use household survey data to quantitatively estimate the relationship between a household’s access to environmental goods and its income level. I define an environmental good as anything that a household can use to produce value and create an economic advantage (economic advantage includes both tangible outcomes, such as income, and intangible outcomes, such as health and human capital). Examples of such goods are fertile soils used to produce crops and water used for drinking, cleaning, and irrigation. An environmental inequality, therefore, occurs when households have differential access to these goods caused either by geographic barriers (i.e. they live too far from a river) or income barriers (they lack the financial means to purchase irrigation systems or fertilizer). The aim of the project is to answer the following two questions: (i) What is the relationship between environmental inequalities and income inequalities in the Limpopo River Basin? and (ii) How does the level of environmental goods and services available to a household influence poverty dynamics and income movements over time?

Methods

The main output from this project will be a comprehensive approach to measuring the relationship between environmental goods and a household’s income and income dynamics. I plan to use quantitative methods in my research, but I will also deepen this analysis with information obtained from focus groups. I will use this preliminary qualitative research to learn about the nuanced ways in which households rely on the environment for livelihood provision. This information will ultimately influence what data are collected in the household survey for use in the quantitative analysis.

In collaboration with the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) in Bulawayo, Zimbabwe I will lead focus groups with village members and collect the first of four rounds of household socio-economic data beginning summer 2012. These data will be collected from approximately 200 Zimbabwean households living in three different districts in the basin (Matobo, Insiza, and Gwanda South). Each household will be interviewed 4 times over the course of a year. Data collected will include information on household demographics, income, consumption, climate, geography and environmental goods such as soil quality, water quality, water quantity, timber, and livestock.

The data collection (the largest cost being the cost of enumerators) will be funded by ICRISAT, in conjunction with the Limpopo Basin Development Challenge, and I will oversee questionnaire development and survey implementation. The questionnaire will be developed

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2The R ratio for any given plot of land is calculated as:

$$R = \frac{\text{years of cultivation}}{\text{years of cultivation} + \text{years of fallow}}.$$

where years of fallow refers to the number of years a field is left uncultivated between harvests.
this spring. This summer I will use information learned in the first round of data collection (June 2012) to tailor future questionnaires. In addition to the data collection, I will fully develop the theoretical framework for my econometric estimation over the course of the summer. This empirical model will be based on preliminary regressions run with the first-round of data and relevant literature in development economics and environmental economics. Preliminary results will be reported on the range of access to environmental goods, income, and household demographics in the sample region. Lastly, I will summarize the information learned through the focus groups.

**Overall Significance**

My research will contribute to the gap in literature that accounts for both development and poverty related problems in two significant ways: (i) I will determine the relationship between environmental inequalities and income inequalities in the Zimbabwean portion of the Limpopo River Basin and (ii) I will estimate how differential access to environmental goods across households affects poverty dynamics. The construction of dynamic poverty measurements that takes into account environmental goods will reveal more about the depth and degree to which rural households rely on the natural environment; this research will give insight into the implicit value that poor rural households place on various environmental goods and services and will allow one to identify the most important environmental goods and services for livelihood provision. Ultimately, this analysis will link important development literature on poverty measurements and poverty dynamics with environmental literature on valuing ecosystem services and non-market goods. Additionally, this research will enable policy makers and development workers in the basin to better estimate the value of environmental resources to poor rural households and to adopt policies that conserve these vital resources while also maintaining an economically viable lifestyle for the Zimbabweans.

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3The 2005 Millennium Ecosystem Assessment broadly defines ecosystem services as the “benefits people obtain from ecosystems” (Millennium Ecosystem Assessment, 2005). A non-market good is anything that is not bought and sold in markets. Non-market goods include household labor, leisure, clean air and water, and healthy fish and wildlife.
II. Timeline

<table>
<thead>
<tr>
<th>Date Range</th>
<th>Task Description</th>
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<tbody>
<tr>
<td>June 2012</td>
<td>Travel to Zimbabwe to train enumerators and collect first round of data.</td>
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<tr>
<td>July 2012 - August 2012</td>
<td>Revise questionnaire as needed. Develop theoretical and empirical framework for paper.</td>
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<tr>
<td>September 2012</td>
<td>Collect second round of data.</td>
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<tr>
<td>February 2013</td>
<td>Collect third round of data.</td>
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<tr>
<td>March 2013 - May 2013</td>
<td>Compile first three rounds of data and analyze results.</td>
</tr>
<tr>
<td>June 2013</td>
<td>Collect final (fourth) round of data.</td>
</tr>
<tr>
<td>July 2013 - Sep. 2013</td>
<td>Complete comprehensive first draft of research paper.</td>
</tr>
</tbody>
</table>

Note: Highlighted cells indicate work to be completed directly as a result of Consortium funds. ICRISAT will oversee collection of the second, third, and fourth rounds of data but I will use my time in Zimbabwe this summer to develop a comprehensive plan for these additional rounds of data collection.

III. Biography

Martha Rogers is a PhD student in the department of Applied Economics at the University of Minnesota. Her research interests include microeconomics of development, environmental economics, and analysis of the environmental and social effects of interactions between individuals and ecosystems. She holds a B.A. in Economics and Mathematics and Statistics from Williams College, where she graduated cum laude in 2007. Martha has experience living and working in South Africa, the Philippines, and Mexico. Her goal is to produce research that effectively links environmental concerns with development concerns in rural agrarian communities that can then be used to develop policies that enhance welfare while minimizing both short and long-term environmental damages. Martha’s research at the University of Minnesota has been supported by the Interdisciplinary Center for the Study of Global Change and a William Stout endowed graduate school fellowship.
References


**Project Title:** What Does the Environment Do For Us: Incorporating Environmental Goods into Poverty Dynamics

<table>
<thead>
<tr>
<th>Personnel costs</th>
<th>Description &amp; justification</th>
<th>Requested funding</th>
<th>Matching/other funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary (stipend): I am requesting funding for 6 weeks of full-time employment on this project (40 hours/week) from June 25th, 2012 - August 6th, 2012.</td>
<td>Salary $4,910 = 250 hrs x $19.64</td>
<td>$4,910.00</td>
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<td><strong>Personnel Subtotal</strong></td>
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<td><strong>$4,910.00</strong></td>
<td><strong>$0.00</strong></td>
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<tr>
<td>Supplies &amp; Services:</td>
<td>Transport to field sites for focus groups and site visits, $75 per trip. (4 trips · $300)</td>
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<td>$300.00</td>
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<tr>
<td>Travel: To Zimbabwe for 2 weeks in July, 2011. Please see below for justification.</td>
<td>Airfare to Johannesburg, South Africa ($2,500 at most) Airfare Johannesburg, South Africa to Bulawayo, Zimbabwe ($450) Per diem at $125/day ($1,750)</td>
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<td>$4,700.00</td>
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<td><strong>Subtotal research supplies, equipment, travel, other</strong></td>
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<td><strong>TOTAL BUDGET</strong></td>
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<td><strong>$0.00</strong></td>
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</tbody>
</table>

1. **Stipend justification.** I will be working on refining the questionnaire, preliminary data analysis, and developing the theoretical model during the summer 2012. I have funding through the end of the academic year and in the Fall but not for summer 2012. I am requesting funding for work to be done June through August 2012.

7. **Supplies and services.** The amounts here are estimated expenses and subject to change.

9. **Travel costs.** Travel to Pretoria, South Africa and Bulawayo, Zimbabwe in June 2012. Airfare to South Africa based on Delta.com search. Airfare to Bulawayo based on a South African airlines search. During this trip I will spend 3-4 days in Pretoria meeting with affiliates at the Food, Agriculture, and Natural Resource Policy Analysis Network (FANRPAN). This organization heads the Limpopo Basin portion of CGIAR’s (Consultative Group on International Agricultural Research) larger Challenge Program on Water and Food. The International Crop Research Institute for the Semi-Arid Tropics directs the portion of the Limpopo Basin study with which I will be collaborating. I will spend the remainder of my trip in Bulawayo overseeing data collection and conducting focus groups and site visits. The length of this trip will be sufficient for me to get invaluable exposure to the field and to verify that sufficient data collection methods have been put in place. ICRISAT will be responsible for funding the data collection and overseeing additional rounds of data collection. Per diem rates are $212 in Bulawayo and $294 in Pretoria.